Astronomical Telescopes and Instruments 2018: Exercises on Thin Films (Due on 23 October 2018 at 13:30)

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1 Reflectivity of Metal Coating

Calculate the reflectivity of an aluminum mirror at normal incidence at wavelengths of 400 nm (n=0.52135, k=5.000), 850 nm (n=2.6945, k=8.1878), and 1650 nm (n=1.5782, k=15.656).

2 Anti-Reflection Coating

Determine the thickness of a single MgF_2 (n=1.37) layer to minimize the reflectivity of an air to glass (n=1.55) interface at an angle of incidence of 45 degrees.

3 Thinfilm Code

Convert the equations of the matrix formalism into a program that can calculate the reflectivity of an arbitrary stack of thin films. The equations can be simplified by using wavelengths relative to λ_0, optical thicknesses expressed in λ_0, only normal incidence and purely real indices of refraction. Use the code to calculate the reflectivity as a function of wavelength from $0.7\lambda_0$ to $1.6\lambda_0$ and at normal incidence for the following thin-film stack:

- air, $n_m = 1.0$
- $n_3 = 1.38$, $n_3 d_3 = 0.205\lambda_0$
- $n_2 = 2.00$, $n_2 d_2 = 0.336\lambda_0$
- $n_1 = 1.80$, $n_1 d_1 = 0.132\lambda_0$
- substrate, $n_s = 1.52$